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THE BULBIFEROUS FORM OF *LUZULA MULTIFLORA*.

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A SPECIES of *Luzula*, which the writer cannot distinguish from the European *L. multiflora* (Ehrh.) Lej., is very frequent in the vicinity of Washington, D. C., notably in adjoining Maryland. It shows the same structure of the inflorescence and flower, but the perianth is somewhat paler, and, moreover, it is frequently bulbiferous. In Buchenau's treatment of the *Juncaceae*,¹ where *Luzula multiflora* is referred to *L. campestris* (Lam.) DC. as a variety, a bulbous plant is mentioned, the so-called *L. campestris* var. *bulbosa* Wood.² Buchenau, however, did not consider this as a variety proper, but merely as a form, corresponding with a similar form of the Australian variety *migrata* Buchenau "caulibus saepe bulbosis" (l. c. p. 94). Since then some other *Luzulae* have been observed to exhibit a similar bulbous structure according to Fernald and Wiegand:³ "occasionally in vars. *macrantha*, *comosa*, *congesta*, and *multiflora* in America," and furthermore Professor Fernald has kindly informed us (in litteris) that he has also observed the development of bulbs in var. *Mannii* from Guinea, and in *Luzula subsessilis* (S. Wats.) Buchenau. The production of bulblets, however, is said to be more general in the var. *bulbosa* Wood than in any of the others.

Regarding the geographical distribution of the var. *bulbosa* Fernald and Wiegand give this as "New Jersey and southeastern Pennsylvania to Georgia, west to Kansas and Texas, and according to Professor

¹ Das Pflanzenreich by A. Engler IV. 36. Leipzig 1906, p. 95.

² Wood, A. Class-book of Botany. New York 1866, p. 723.

³ M. L. Fernald and K. M. Wiegand. The variations of *Luzula campestris* in North America. RHODORA Vol. 15. 1913, p. 38.

Fernald (in litteris) the distribution has been extended north through southern New England into southeastern Massachusetts, where this variety forms a part of the characteristic flora of coastal plain dispersal. Thus so far as concerns the geographical distribution the bulbiferous *Luzula*, which we intend to describe, might well be referable to var. *bulbosa* Wood, if it were not for the fact that our material shows the perianth-leaves to be distinctly longer than the mature capsule. We remember that Wood's diagnosis calls for a plant with "sepals shorter than the globular capsule," and as stated by Professor Fernald (in litteris) this character and the production of numerous bulbs distinguish it at once.

With reference to our plant we can find no other character of importance by which to distinguish it from *Luzula multiflora* than the frequent development of bulbs. When we consider *Luzula multiflora* Lej. as a species distinct from *L. campestris* DC., contrary to the view of Buchenau and so many other prominent writers on the genus, this has always been our opinion since the time, when in Denmark we had the opportunity to study both species occurring in abundance. It would not be the place here to discuss in detail the characters by which these two species may be distinguished, but the following citation from Lange's *Conspectus Florae Groenlandicae* (Copenhagen 1880, p. 125) contains the most essential points: "*Luzula multiflora* Lej. Crescendi modo dense caespitoso, multicauli, glomerulis densifloris, erectis, florendi tempore magis serotino bene distincta mihi videtur a *L. campestris*, quae rhizomate repente, caulibus florigeris sparsis, glomerulis pendulis, magis laxifloris instructa est."

In Denmark the flowering time is so different, that *Luzula campestris* has almost mature fruits, when *L. multiflora* begins to bloom. We also wish to refer to Lindman's excellent work on the Flora of Sweden,¹ where they are described as distinct species. The geographic distribution seems to be in favor of the view that they represent distinct species, for according to Buchenau (l. c.) typical *Luzula campestris* is only frequent in temperate Europe; from countries outside of Europe, Buchenau saw material only from Algiers, Nilgherries, Altai and Trapezunt. On the other hand *Luzula multiflora* abounds in temperate Europe, Asia and North America. In the paper by

¹ Lindman, C. A. M. *Svensk Fanerogamflora*. Stockholm 1918, p. 157. See also Buchenau: *Kritisches Verzeichniss aller bis jetzt beschriebenen Juncaceen*. Naturwiss. Verein Bremen 1880, p. 101, where this author considered it most natural to recognize *Luzula campestris*, *L. multiflora* and *L. pallescens* as distinct species.

Fernald and Wiegand (l. c.) *Luzula campestris*, although apparently absent from North America, as it seems according to the statement of Buchenau: "für N. America nicht sicher," is treated as a polymorphous species with nine varieties, including *L. multiflora*, said to be the most widely distributed of these.

Considering the varieties enumerated by Fernald and Wiegand (l. c.) these are, according to our opinion, closely related to *Luzula multiflora* with exception of *L. comosa* Meyer including the varieties: *congesta* Wats. [not to be confounded with *congesta* (Thuill.) Buchenau], *laxa* Buchenau, *macrantha* Wats. and *subsessilis* Wats., for the habit of these is very different from that of *L. multiflora* and *L. campestris*. Buchenau himself kept the *comosa*-alliance separate from that of *campestris*, and he even referred the var. *subsessilis* Wats. to another section describing it as a species *L. subsessilis* (S. Wats.) Buchenau next to *L. caricina* E. Mey. (l. c. p. 67). It seems strange that Buchenau separated *Luzula subsessilis* from the *comosa*-alliance, for as shown by the diagnoses, Buchenau was well aware of the singular structure of their inflorescence "spica infima saepe remota, longe stipitata," besides the structure of the single spikes, as compared with those of the other species. Such morphologic structures are important to classification, but they are frequently overlooked.

With regard to the development of bulbs we have seen above, that this is not restricted to a single species or variety, whatever it be, but that it occurs in *Luzula multiflora vera*, in *L. comosa* including its varieties, and in some few others. The structure of these bulbs was described by Buchenau¹ and his material came from Montenegro and New Holland. The plants having been dried did not show the structure with sufficient distinctness, thus the diagnosis: "Basis caulis et foliorum incrassata ut bulbus formata" does not indicate the singular habit of this interesting form.

Luzula multiflora being frequent in our vicinity we have had fresh material at our disposal, and, moreover, we have had the opportunity to study the plant in the various parts of the season. The vernal stage shows the original position of the bulbs, the autumnal their final, morphologic structure. The plant is bulbiferous and the bulbs represent axillary buds, situated in the axils of the basal, membranace-

¹ Buchenau, Fr. Ueber Knollen und Zwiebelbildung bei den Juncaceen. Flora 1891, p. 77.

ous leaves of the aerial, floral and vegetative shoots. Young specimens (Fig. 1) purely vegetative begin with a membranaceous, scale-

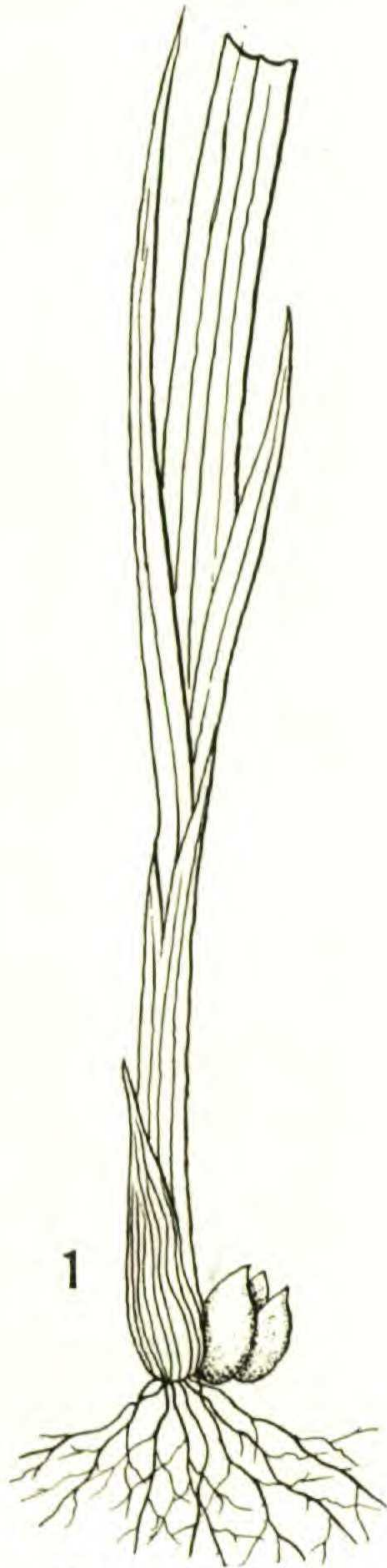


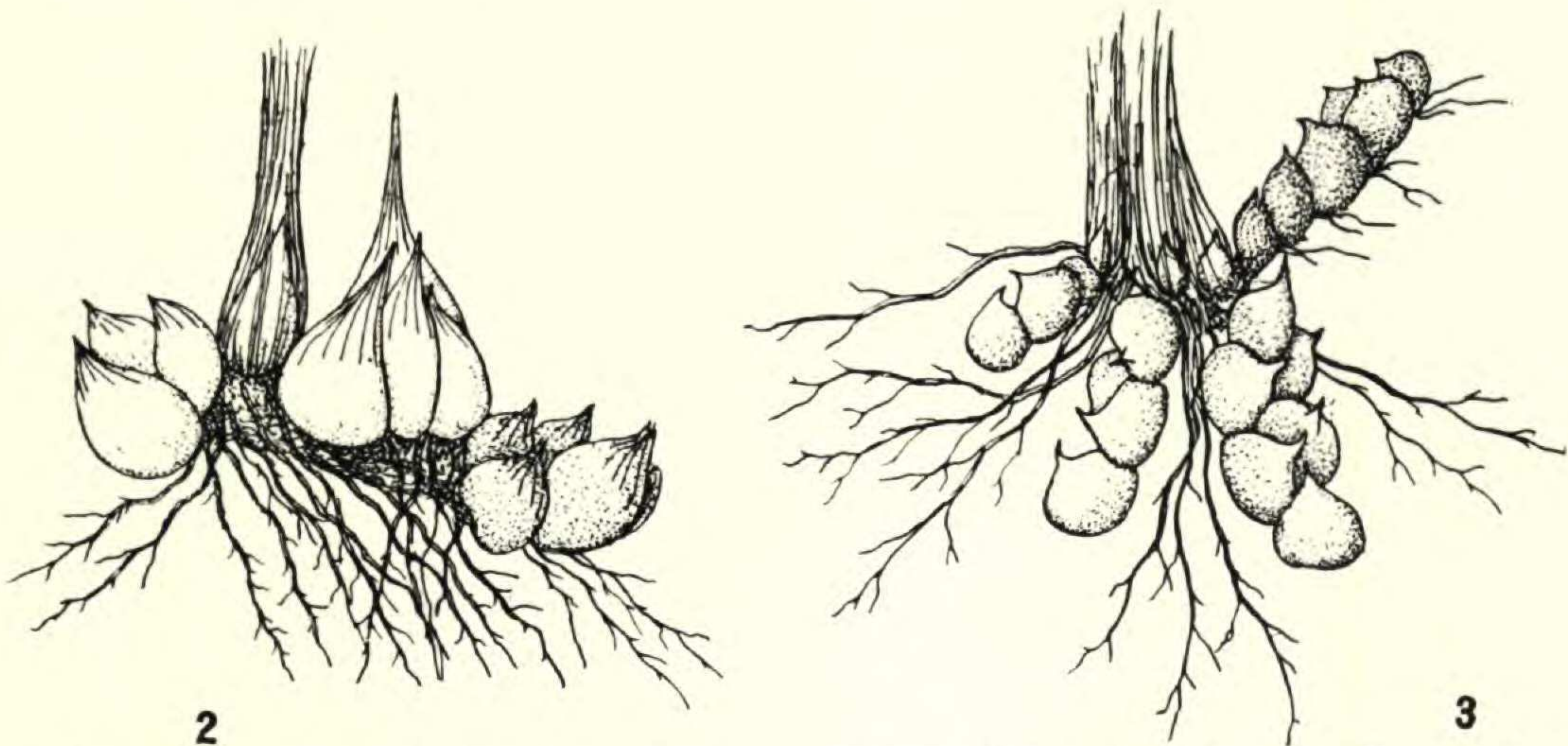
Fig. 1. Young specimen of *Luzula multiflora* Lej. forma *bulbosa*.

like leaf preceding the green ones, and a small bulb is always developed in the axil of the first leaf, the membranaceous one. At the base of the shoot a relatively large bulb is very conspicuous, representing the only part left of the preceding year's growth, and the specimen figured was collected in the early spring. When examined at the autumnal stage, such young specimens show two bulbs, since the scale-leaves have withered and become torn by the growth of the bulb; the green leaves persist through the winter, surrounding the terminal bud, which generally develops into a floral shoot in the succeeding year.

The explanation of the position and morphological structure of the bulb is actually given by such young specimens. The plant has dimorphous buds: the apical developing leaves and shoots of the typical structure of *Luzula*, the axillary having succulent scale-leaves and never producing aerial shoots, being simply storage-organs. In mature specimens, densely caespitose, with several floral and many vegetative shoots, the position of the numerous bulbs is very complicated unless the young stage has been studied. Figs. 2 and 3 illustrate the autumnal stage of old plants, and it is readily to be noticed that none of the bulbs have increased in growth beyond a considerable thickening of the bulb-scales; there is no indication of any aerial shoots having been developed from

these bulbs, but the original arrangement of the bulb-scales (Fig. 3) has become disturbed by the slow, but continuous growth of the axis, that bears the bulbs, imitating a stoloniferous habit. In figure 2 we have drawn some large bulbs of the typical form during the summer, and some of the bulb-scales show a distinct apex, a rudi-

mentary blade, hairy as the green leaves. The structure of the bulb-scales is somewhat peculiar; they consist of a very thick body with the margins relatively broad hyaline, and composed of the epidermis alone. The chlorenchyma of the scales is very compact, homogeneous, consisting of many strata of isodiametric cells, filled with starch. There are mostly seven very thin mestome-strands in one band; they are of the collateral type and are supported by stereome, thick-walled and especially well represented on the hadrome face,



Figs. 2 and 3. Bulbs of mature specimens of the same form, collected in the fall. The figures about twice natural size.

while in the green leaves the leptome has the greater, mechanical support. A cross-section of a bulb shows three to five thick scales surrounding a few much smaller and thinner ones, which fail to develop any further. None of the specimens examined showed the base of the floral stem to be bulbous. The subterranean stem is profusely branched, but the internodes are very short; they contain a homogeneous cortex of about five strata with deposits of starch; an endodermis thickened in the manner of a U-endodermis; a band of about 18 mestome-strands, several being of the leptocentric type, and surrounded by thin-walled stereome; the narrow pith is solid, and starch-bearing.

We have thus in this form of *Luzula multiflora* a plant with dimorphous buds, the bulbous being exclusively axillary, performing the function of storage organs, and never producing any aerial shoots, while the typical buds are terminal and produce vegetative and floral shoots.

The bulbiferous form is the most frequent in this vicinity, but we do not believe that the environment plays any rôle of importance, since we have found this form in sandy soil at the border of pine woods as well as in deciduous woods with rich humus.

None of the species of the sections *Pterodes* and *Anthelaea* exhibit this structure; it is confined to *Gymnodes*. In *Luzula nodulosa* (Bory) E. Mey. of the last section the rhizome is moniliform, but tuberous, not bulbiferous; similar tuberous rhizomes are known from several species of *Juncus*, for instance *J. nodosus*, *J. marginatus*, etc., while bulbs or bulb-like formations, known in the inflorescence of various species of *Junci septati* and *graminifolii* are caused by insects, *Livia* for instance.

CLINTON, MARYLAND.

ON SOLIDAGO RIGIDA L., AND THE APPLICATION OF OLD BOTANICAL NAMES.

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Mr. Mackenzie's recent article on *Solidago rigida*,¹ in which he concludes that that name belongs to the species generally known as *S. patula* Muhl., furnishes a striking illustration of the uncertainties into which we are likely to be led by a strictly historical—one is tempted to say archaeological—method of determining the application of Linnaean and other old botanical names. For the case is by no means so clear to others as it appears to him.

It may be that the description of *Solidago rigida* in the *Species Plantarum* is not to be regarded as original there, though Linnaeus, in making it up, did revise the quoted diagnosis from the *Hortus Cliffortianus* to the extent of adding the word "scabris"; nor as based on the specimen in the Linnaean herbarium. But that specimen may have been part of the basis of the undoubtedly original description in the *Hortus Cliffortianus*; Linnaeus received "all the duplicates of the Clifford herbarium"² and for aught Mr. Mackenzie tells us, this may have been one of them. It might have been well to determine this point before altogether rejecting the specimen as representative of the species.

¹ RHODORA xxviii. 29-31 (1926).

² See Jackson, Proc. Linn. Soc. cxxiv, suppl. 11 (1912).